ARID Technologies' Inc. Comments on the

dKC de la Torre Klausmeier Consulting

DRAFT REPORT

ANALYSIS OF FUTURE OPTIONS FOR CONNECTICUT'S GASOLINE DISPENSING FACILITY VAPOR CONTROL PROGRAM

19 January, 2012

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Introduction

ARID Technologies, Inc. was founded in 1993, and the company specializes in the design and manufacturing of vapor recovery equipment used at gasoline dispensing facilities. ARID does not manufacture Stage II vapor recovery equipment; however the company does manufacture a membrane based vapor processor called PERMEATOR. The ARID Permeator enhances existing Stage II vapor recovery technology by actively managing storage tank pressure. By selectively separating hydrocarbon vapors from air, the storage tank pressure is reduced while at the same time valuable fuel is conserved and atmospheric emissions are avoided.

ARID was not contacted by Mr. Klausmeier in preparing his dKC draft report submitted to the State of Connecticut. ARID takes this opportunity to provide our view on the report submitted by Mr. Klausmeier.

Widespread Use

The EPA Proposal to eliminate Stage II vapor recovery, if followed, will not result in the most cost effective means to reduce pollutants and will not save valuable fuel. In fact, our data show that emissions will be significantly increased above the levels possible with state-of-the-art technology; which has already been proven and is commercially robust.

Details

In general, vapor emissions at gasoline dispensing facilities (GDF) are comprised of refueling emissions and storage tank emissions. In turn, refueling emissions are generated at the nozzle/vehicle interface and at the outlet from the carbon canister used on the ORVR systems. The storage tank emissions are comprised of vent line emissions through the pressure/vacuum valve (p/v valve) and fugitive emissions through various point sources within the vapor containing hardware; where the vent & fugitive emissions are a function of storage tank pressure.

The goal for the GDF is to minimize the total emissions VOC's and HAP's (Volatile Organic Compounds and Hazardous Air Pollutants); which is the sum of the refueling and storage tank emissions. Traditionally, a practical tradeoff existed where the A/L (Air to Liquid) ratio of the Stage II system could be increased to improve vapor collection at the nozzle/vehicle interface; however, this increase in A/L results in air ingestion into the storage tank with a penalty in fuel evaporation, tank pressurization and the generation of both vent and fugitive emissions. With ORVR alone, air ingestion via Stage II is minimized, however air will still be ingested through the vent line and many non-ORVR vehicles will emit raw, uncaptured hydrocarbons directly into the vicinity of the refueling motorist; or to an adjacent motorist. To adequately optimize a solution for the GDF, both sets of emissions must be considered simultaneously.

Why give up one molecule of toxic vapor capture or containment; especially if the means to capture and contain the vapor yield a favorable economic payback?

ORVR and Stage II Emissions

In our view, the concept of ORVR "widespread use" is a flawed idea. It's primary flaw centers on the "breakeven" or "cross over point" ; where the emissions from ORVR alone are said to equal the emissions from Stage II only is not supported by the math; …. the proper math that is. What is neglected in this discussion is a proper accounting of the hydrocarbon emissions from non-ORVR vehicles; where Stage II systems are not in use. It is best to illustrate this important point by example; if the throughput of a given gasoline dispensing facility (GDF) is 150,000 gallons per month; and if one assumes an emission factor of 8.4 lbm of hydrocarbons per 1,000 gallons of fuel dispensed; the following assumptions and calculations can be carried out:

1. Assume Stage II Recovery In-Use Efficiency of 86%
2. Assume ORVR In-Use Efficiency of 95% (neglecting any subsequent drop-off as a function of time)
3. Assume ORVR penetration rate as shown in attached Table 1: "Refueling Emissions"; for year 2013, ORVR penetration is 72%

Table 1 below shows refueling emissions as a function of ORVR penetration rate under a range of scenarios. The emissions are tabulated for a sample GDF site with 150,000 gallons per month of throughput.

First, calculate the uncontrolled refueling emissions from this site:

Uncontrolled Refueling Emissions =150,000 gal/month x 8.4 lbm/1,000 gal = 1,260 lbm per month x 12 months/year = 15,120 lbm/year (This is column 1 in Table 1)

Next, calculate the refueling emission with only ORVR; assume ORVR efficiency of 95% and ORVR penetration of 72%, from year 2013

ORVR Emissions = 1,260 lbm/mo. x (.72) x (1 - .95) + 1,260 lbm/mo. x (1 - .72) = 45.36 + 352.8 = 398.16 lbm/mo. x 12 months/year = 4,777.92 lbm/year (This entry is found in column 2, for year 2013 in Table 1); please note that this figure is derived from the ORVR penetration x (1 - the ORVR efficiency): 45.36 lbm/mo. and then one has to also ***add the raw emissions*** (on the right side of the equation; 352.8 lbm/mo.) ***from non-ORVR vehicles*** to yield the sum of 398.16 lbm/mo. Please note that the raw emissions exceed the controlled emissions by a factor of 352.8/45.36, or 7.8 times.

In another context; if the ORVR efficiency is 95%; the raw emissions from a non-ORVR vehicle represent twenty times the emissions from an ORVR equipped vehicle (1/.05). In Connecticut, the population of automobiles is approximately 2 million (1,999,809, US Dept. of Transportation, Federal Highway Administration, Highway Statistics, 2006). Thus, if ORVR penetration is 72% in year 2013; then 28% or 560,000 vehicles do not have ORVR. Using the factor from above; upon refueling each "batch of 560,000 cars", the raw emissions will be equivalent to 20 x 560,000 or 11,200,000 vehicles. This far exceeds the total vehicle population by a factor of 5 times.

- In the Klausmeier report, the author cites an annual Connecticut gasoline throughput of 1,514,621,566 gallons (based on year 2010 data). If we assume these gallons are approximately evenly distributed among the 2 million vehicles in Connecticut; the annual consumption per vehicle is 757 gallons per year. Assume further a fill-up volume of 13 gallons per refueling. Then, the average number of fill-ups per car in CT is 757/13 = 58. So the average driver fills up his/her vehicle, 58 times per year. Thus, in year 2013, the equivalent emissions from non-ORVR vehicles refueling at non Stage II sites is 20 x 560,000 x 58 = 649,600,000 cars. The ORVR equipped vehicle emissions for the same period are .72 x 2,000,000 x 58 = 83,520,000 cars; where the non –ORVR vehicles contribute an additional emissions burden of 566,080,000 cars! This is simple math; and clearly this sub-optimal scenario should not be desired by the State of Connecticut. Please reference this link for video of a refueling event with a non-ORVR vehicle at a non-Stage II GDF: http://www.youtube.com/watch?v=E8Hoj-_v0W4&feature=related
- These vapor emissions include benzene, a known carcinogen and toxic component.

Further Analysis

We have first showed in very simple terms why elimination of Stage II and sole reliance on ORVR-only is not prudent, and that the notion of WSU (Widespread Use) is flawed. The cost of terminating the Stage II program and relying solely on ORVR will yield significant increases in emissions for CT in comparison to a State-of-the-Art alternative. These increases are further quantified and tabulated below.

Table 1: Refueling Emissions: Single GDF

			1	2	3
Year	**ORVR Penetration Rate**	**Gasoline Throughput**	**Refueling Emissions**	**Refueling Emissions**	**Refueling Emissions**
		gal/month	*No Stage II/ No ORVR*	*No Stage II/ **With ORVR***	*With Stage II/ With ORVR*
			lbm/year	*lbm/year*	*lbm/year*
2011	69%	150,000	15,120	5,208.84	1,512.00
2012	71%	150,000	15,120	4,921.56	1,512.00
2013	72%	150,000	15,120	4,777.92	1,512.00
2014	74%	150,000	15,120	4,490.64	1,512.00
2015	75%	150,000	15,120	4,347.00	1,512.00
2016	77%	150,000	15,120	4,059.72	1,512.00
2017	78%	150,000	15,120	3,916.08	1,512.00
2018	79%	150,000	15,120	3,772.44	1,512.00
2019	80%	150,000	15,120	3,628.80	1,512.00
2020	81%	150,000	15,120	3,485.16	1,512.00

Column 3, ***Refueling emissions with Stage II and with ORVR*** is calculated by assuming that the recovery efficiency is increased to 90%; thus (1-.90) or 10 % of the column 1 emissions result.

Continuing on, we next consider the impact of storage tank vent and fugitive emissions (The Klausmeier report refers to these emissions as Incompatibility Excess Emissions, IEE). These emissions are important to include in the analysis since the sum of the refueling emissions and the vent and fugitive emissions represents an accurate picture of the total emissions experienced at the GDF site.

Table 2: Vent, Fugitive & Total Emissions (including IEE Emissions)

4	5	6	7	8	9	10
Storage Tank Vent & Fugitive Emissions	**Storage Tank Vent & Fugitive Emissions**	**Storage Tank Vent & Fugitive Emissions**	**Total Emissions (Refueling + Storage Tank)**	**Total Emissions (Refueling + Storage)**	**Total Emissions**	**Total Emissions**
With Stage II/ with ORVR No Processor	*No Stage II/ with or without ORVR No Processor*	*With Processor*	*No Stage II, No ORVR, No Processor*	*No Stage II, With ORVR, No Processor*	*Stage II & ORVR, no Processor*	*Stage II, ORVR with Processor*
lbm/year	*lbm/year*	*lbm/year*	*lbm/year*	*lbm/year*	*lbm/year*	*lbm/year*
6,570	2,190	45.99	17,310	7,399	8,082.00	1,557.99
6,796	2,265	47.57	17,385	7,187	8,307.95	1,559.57
6,997	2,332	48.98	17,452	7,110	8,509.21	1,560.98
7,156	2,385	50.09	17,505	6,876	8,668.23	1,562.09
7,231	2,410	50.62	17,530	6,757	8,742.87	1,562.62
7,307	2,436	51.15	17,556	6,495	8,819.02	1,563.15
7,385	2,462	51.69	17,582	6,378	8,896.68	1,563.69
7,464	2,488	52.25	17,608	6,260	8,975.90	1,564.25
7,545	2,515	52.81	17,635	6,144	9,056.70	1,564.81
7,627	2,542	53.39	17,662	6,028	9,139.11	1,565.39

In Table 2 above, column 4 is calculated by using an average of two emission factors measured by actual field tests conducted at GDF using Stage II vacuum assisted vapor recovery systems. These entries represent the emissions from the storage tank at a GDF using Stage II vacuum assisted systems in conjunction with ORVR vehicles, at the penetration rates listed in Table 1. For column 4 entries, no processor is employed to actively manage the storage tank pressure.

As seen in Appendix 1, the Draft Paper entitled, "**Stage II Vapor Recovery Systems —Options Paper",** U.S. EPA, Office of Air Quality Planning and Standards, Emissions Monitoring and Analysis Division, Emissions Factors and Policy Applications Group (C339-02), February 7, 2006,P 132-p 135; IEE = 3.48 lbm/1,000 gal. The second reference, attached as Appendix 2 of this report is entitled, "Vent Line and

Fugitive Emissions Study, National Gasoline Dispensing Facility", ARID Technologies, Inc., 30 December 2009, P 10; IEE = 3.82 lbm/1,000 gallons; derived as follows; (617.568 gal evaporated/month)/ (806,404 gal dispensed/mo.) x 1,000 x 5 lbm/gal).

Thus, the average emission factor used for year 2011 is (3.48 + 3.82)/2 = 3.65 lbm/ 1,000 gallon. (dKC notes a range of 0.42 lbm/1,000 gal to 2.5 lbm/1,000 gallons; perhaps Mr. Klausmeier overlooked our EPA reference) It should be noted that this factor was increased in subsequent years due to the increasing population of ORVR vehicles, in accordance with Table 1; as ORVR penetration increases, the IEE will increase due to leaner vapors being returned to the storage tank vapor space, which in-turn causes a reduction in hydrocarbon concentration in the vapor space and results in the evaporation of liquid phase gasoline. For simplicity, Table 2 does not list the years (2011 – 2020) on the left hand side of the table. It should also be noted that the IEE measured in the referenced field tests above represents the IEE at only a relatively small range in time; where the combination of several key variables dictates the effective, seasonally adjusted overall emission factor.

ARID has derived a proprietary Evaporative Loss Model (ELM) which considers the impact of key parameters such as fuel storage tank temperature, fuel RVP (Reid Vapor Pressure), A/L ratio of the Stage II system, ORVR penetration, and altitude of the GDF. Based on ARID's extensive field data and practical operating experience, we believe the actual emissions factors (over an annual period) to be much larger than the factors obtained during the field test periods noted above.

Column 5 in Table 2 above represents the storage tank emissions from a GDF not using Stage II, with or without ORVR, and no vapor processor. The presence or absence of ORVR does not impact the air ingestion into the storage tank; which will be via the vent line after the negative cracking pressure of the pressure/vacuum (p/v) valve is reached. Typically, the air ingestion will occur when a negative pressure of -6 to -8 inches of water column is reached. Column 5 entries are derived by dividing column 4 entries by 3. This is a representative figure from field tests on USA GDF sites.

Column 6 in Table 2 above represents the storage tank emissions from a GDF using Stage II vacuum assisted vapor recovery, ORVR vehicles and a processor to actively manage storage tank pressure. Column 6 entries are derived by applying a recovery efficiency of 99.3% to column 4 entries (The 99.3 % recovery efficiency is listed for ARID's PERMEATOR system on page 133 of the "**Stage II Vapor Recovery Systems — Options Paper"** reference noted previously.) Thus, column 6 entries = column 4 x (1-.993).

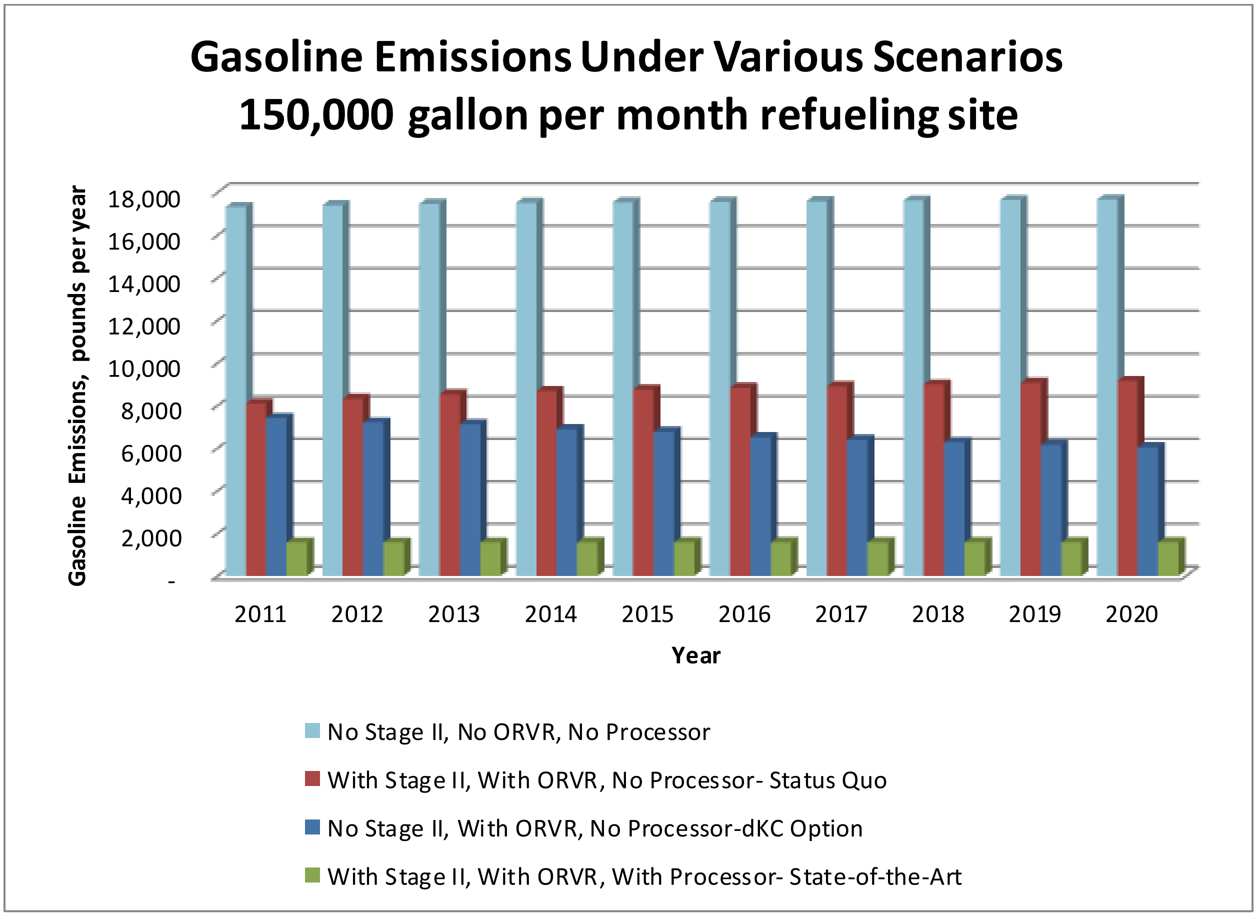
Column 7 in Table 2 represents the sum of the refueling emissions (Table 1, column 1) and the storage tank emissions (Table 2, column 5); where No Stage II, No ORVR and No Processor are used at the GDF. This is the worst case scenario, with no controls on refueling or the storage tank.

Column 8 in Table 2 represents the sum of the refueling emissions with ORVR (Table 1, column 2) and the storage tank emissions (Table 2, column 5); where No Stage II, and No Processor are used at the GDF; with sole reliance on ORVR for emissions reductions. This scenario represents the recommendation made by Mr. Klausmeier.

Column 9 in Table 2 represents the sum of the refueling emissions with Stage II and ORVR (Table 1, column 3) and the storage tank emissions without Processor (Table 2, column 4); where Stage II and ORVR are used at the GDF, but a vapor processor is not employed. This scenario represents the status quo for CT GDF not employing processors.

Column 10 in Table 2 represents the sum of the refueling emissions with Stage II and ORVR (Table 1, column 3) and the storage tank emissions with a Processor (Table 2, column 6); where Stage II, ORVR and a Processor are used at the GDF. This scenario represents the state-of-the-art solution for GDF.

Chart 1: Relative Emissions: Refueling & Storage Tank



As seen in Chart 1, clearly, the ORVR-only case is not an optimum alternative. For the period 2011 thru 2020; the total emissions under each scenario are as follows:

- Worst Case (No Controls): 175,226 lbm
- Status Quo: Stage II, With ORVR, No Processor: 87,198 lbm
- Klausmeier (dKC) Recommendation: No Stage II, ORVR, No Processor: 66, 634 lbm
- State-of-the-Art: ARID: Stage II, ORVR, with Processor: 15,625 lbm

The Klausmeier recommendation may look attractive relative to the No Processor option; however, when compared to the State-of-the-Art option using a Processor, the Klausmeier option shows an increase of 51,009 lbm of emissions, or an increase of 25 tons of hydrocarbon vapor emissions.

Table 3: Emissions Summary: Single GDF, 10 year time horizon

	Uncontrolled	*Status Quo*	*Klausmeier*	*State-of-the-Art*
	lbm	*lbm*	*lbm*	*lbm*
	175,226	87,198	66,634	15,625
% Reduction vs. Uncontrolled	0	50.2%	62.0%	91.1%
% Reduction vs. Klausmeier				76.6%

The State-of-the-Art option represents a 91.1% reduction in atmospheric emissions (in close proximity to the motorist), while at the same time saving a large volume of salable fuel and yielding a rapid payback on invested capital for the gasoline dispensing facility owner/operator. In addition to increased operating efficiency, the risk of groundwater contamination via below grade fugitive emissions is also significantly reduced. Moreover, the State-of-the-Art option using an ARID PERMEATOR represents a further 76.6% reduction in emissions in comparison to the Klausmeier proposal.

A Note about Pressure Integrity and Failure Modes

In the Klausmeier study, the author highlights the high failure rate of Stage II vacuum assisted systems in terms of vapor leakages, and he proposes a lower than 86% in-use vapor recovery efficiency factor. It should be noted that GDF equipped with Stage II vacuum assisted systems (not equipped with vapor processors) operate at a relatively high pressure for a large majority of the time. With reference to the attached "Vent Line and Fugitive Emissions Study, National Gasoline Dispensing Facility" found in Appendix 2; page 6 shows that the storage tank pressure at this site exceeded +2 inches of water column pressure for 93.73% of the time, during the interval 9 October – 20 November 2009. The cracking pressure of the p/v valve at this site is + 3 inches of water column. Since the storage tank is exerting a nearly constant, high back pressure on the storage tank hardware and associated piping, leaks are to be expected. In fact, the likelihood for leaks forming in the p/v valves, automatic tank gauge caps, overfill drain valves and other tank fittings is increased by the prevailing tank pressure. In addition, the pressure spikes during bulk tanker deliveries (Stage I operations) are also amplified by the high baseline starting pressure. It is ARID's contention that the use of active vapor processors such as PERMEATOR will yield a significant reduction in observed vapor leakages; since the storage tank pressure will be managed to a very low level; during normal operations and also during transient periods with bulk tanker deliveries. In addition, failure modes associated with A/L ratio failures are typically due to low A/L values; where again, the high back pressure in the storage tank does not allow the vacuum pump within the dispenser to reach its rated output level. By reducing the prevailing back pressure, the A/L ratios should revert back to their design values since the dispenser based vacuum pumps will not have to overcome a high back pressure. As such, Stage II vapor recovery efficiencies will be increased, and the incidence of vapor leakages should be decreased.

It should also be noted that the ARID Permeator is equipped with pressure sensors, a data logger, and remote data acquisition equipment to provide continuous monitoring of storage tank pressure integrity; with outgoing alarms automatically sent if measured parameters fall outside of a prescribed range. (Please note that ARID's data acquisition and storage equipment was used in the NH Study referenced in the Klausmeier report).

A Note on IEE Mitigation

The Klausmeier report mentions several options for minimizing incompatibility excess emissions. ARID would like to highlight technical details as follows:

Please note distinction between "Active processor" and "passive carbon canister"
. Active processor such as Permeator responds to all pressure excursions such as atmospheric pressure variation, bulk tanker deliveries, diurnal breathing, and evaporative losses. The Permeator has high turn-up capability for processing pressure and volume spikes associated with multiple compartment drops during bulk fuel deliveries.
. Passive canister has limited adsorption capacity and cannot be regenerated under positive pressure in the storage tanks (Stage II Vac Assist Systems); moreover, even with slight negative pressure which may develop in the storage tanks (Stage II Balance Systems); driving force for regeneration will quickly diminish as adsorbed molecules are desorbed and go back into vapor phase

- CT estimates 95% vac assist population.

- Nozzle which is designed to limit air ingestion from vacuum pump during fueling of ORVR vehicles has limited benefit
. If the motorist pumps 10 gallons of fuel to their car, and only 4 gallons of air/hydrocarbon vapor are returned to the storage tank; the storage tanks will quickly reach the negative cracking pressure of the p/v (pressure/vacuum valves); and atmospheric air will be ingested through the vent line; thus the remaining balance of 6 gallons of air will be ingested via the vent line. At the same time, raw uncaptured hydrocarbon vapors will be allowed to escape at the nozzle/vehicle fill pipe interface (with ORVR, there are still emissions at the nozzle/fillpipe interface). Moreover, when fueling rates are reduced or the GDF closes for business; due to the constant ingestion of ambient air, the storage tank vapor space will lean out, and gasoline will evaporate from liquid phase to vapor phase, pressurize the tank, and escape from the p/v vent. The nozzle itself is unable to "process" the resulting extra vapor volume.

- Balance System conversion: the conversion of vacuum assisted systems to balance systems has operational and technical challenges. From an operational standpoint, the use of bigger, bulkier nozzles represent an added challenge for the average motorist. Also, the fuel flow rates with balance systems tend to be lower due to flow on the inner, smaller diameter coaxial hose. In addition, condensation and evacuation of resulting liquid phase fuel along the vapor return path has proved to be troublesome. Moreover, it is known that the negative pressure developed in the vehicle fill pipe via a venturi flow pattern can draw vapors from the GDF storage tank to the

ORVR canister; this reverse flow pattern puts extra load on the ORVR canister and can negatively impact adjacent fueling positions.

Cost Effectiveness

As previously mentioned, ARID has developed a proprietary Evaporative Loss Model, the ELM is presented below:

ARID TECHNOLOGIES - Evaporative Loss Model for Typical Stage II Vac-Assist site

INPUTS			
Monthly Throughput (gallons)	150,000	Vapor/Liquid Ratio	1.05
Monthly Gasoline Gallons Saved Yr 2013	302	Gasoline RVP	10.00
Daily Gasoline Gallons Saved Yr 2013	10.05	Storage Tank Temperature	75.00
Gasoline Saved, Year 2013, % of throughput	0.20%	Depreciation Life (yr)	5.00
System Installed Cost	$40,000.00	Altitude (feet above sea level)	750
Discount Rate	10%	Lessee Discount Rate (After Tax)	10%
Value of Recovered Gasoline	$3.50		

BENEFIT SUMMARY		
OWNING UNIT		
After Tax IRR		23%
After Tax NPV @	10%	$20,839
Total Avoided Emissions (Tons)		98.68

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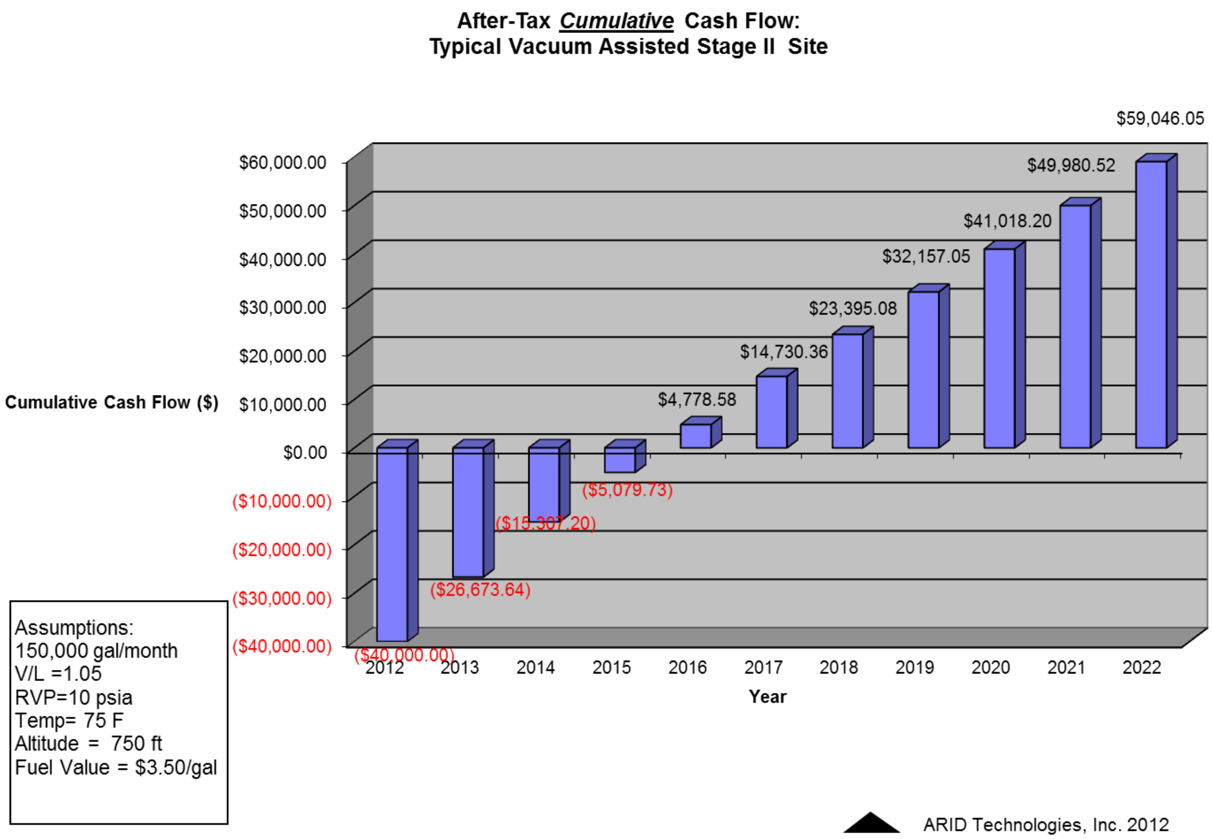
PRODUCT SAVINGS	Coefficients	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
ORVR Vehicle Population			78.6%	80.2%	81.8%	83.4%	85.1%	86.8%	88.6%	90.3%	92.1%	94.0%
Evaporative Emissions, V/L =xx, Tons/Yr-Station	1.05		7.43	7.53	7.62	7.73	7.83	7.93	8.04	8.15	8.26	8.37
Recovery with Membrane (Tons of Gasoline)	99.3%		7.38	7.47	7.57	7.67	7.77	7.88	7.98	8.09	8.20	8.32
Pounds of Gas Saved (1 ton =2,000 lbs)			14,753.29	14,945.73	15,142.01	15,342.23	15,546.44	15,754.75	15,967.21	16,183.93	16,404.98	16,630.45
Gallons of gas Saved (5.2 lb = 1 gallon)			2,837.17	2,874.18	2,911.93	2,950.43	2,989.70	3,029.76	3,070.62	3,112.29	3,154.80	3,198.16

CASH FLOW FOR PURCHASED UNITS	Coefficients	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Value of Liquid Gasoline Saved	$3.50		$9,930.10	$10,059.62	$10,191.74	$10,326.50	$10,463.95	$10,604.16	$10,747.16	$10,893.03	$11,041.81	$11,193.57
Bulk Tanker Loading Savings			$2,738.08	$2,738.08	$2,738.08	$2,738.08	$2,738.08	$2,738.08	$2,738.08	$2,738.08	$2,738.08	$2,738.08
Subtotal Product Savings			$12,668.18	$12,797.70	$12,929.82	$13,064.58	$13,202.03	$13,342.23	$13,485.24	$13,631.11	$13,779.89	$13,931.65
Annual Capital, Operating & Maintenance Expenses	1.50%	($40,000.00)	($600.00)	($600.00)	($600.00)	($600.00)	($600.00)	($600.00)	($600.00)	($600.00)	($600.00)	($600.00)
Depreciation: 5 year ACRS			($16,000.00)	($9,600.00)	($5,760.00)	($4,320.00)	($4,320.00)	$0.00	$0.00	$0.00	$0.00	$0.00
Incremental Operating Income			($3,931.82)	$2,597.70	$6,569.82	$8,144.58	$8,282.03	$12,742.23	$12,885.24	$13,031.11	$13,179.89	$13,331.65
Incremental Tax Expense	32.00%		($1,258.18)	$831.26	$2,102.34	$2,606.26	$2,650.25	$4,077.51	$4,123.28	$4,169.95	$4,217.56	$4,266.13
Incremental Net Income After Tax			($2,673.64)	$1,766.44	$4,467.48	$5,538.31	$5,631.78	$8,664.72	$8,761.96	$8,861.15	$8,962.33	$9,065.52
Add Back Depreciation			$16,000.00	$9,600.00	$5,760.00	$4,320.00	$4,320.00	$0.00	$0.00	$0.00	$0.00	$0.00
After Tax Cash Flow		($40,000.00)	$13,326.36	$11,366.44	$10,227.48	$9,858.31	$9,951.78	$8,664.72	$8,761.96	$8,861.15	$8,962.33	$9,065.52
Cumulative Cash Flow		($40,000.00)	($26,673.64)	($15,307.20)	($5,079.73)	$4,778.58	$14,730.36	$23,395.08	$32,157.05	$41,018.20	$49,980.52	$59,046.05
Volume saved/month (gallons)		316.27	301.62	304.71	307.85	311.06	314.33	317.67	321.08	324.55	328.09	331.71
% Throughput Saved		0.21	0.201	0.203	0.205	0.207	0.210	0.212	0.214	0.216	0.219	0.221
gallons saved per day		10.54	10.05	10.16	10.26	10.37	10.48	10.59	10.70	10.82	10.94	11.06

The cumulative cash flow for this model is presented below:



For the inputs noted in the ELM; the fuel savings from operation of the PERMEATOR are shown to be about 2 gallons of fuel per 1,000 gallons of fuel dispensed. It should be noted that this volumetric savings rate corresponds to a mass savings rate of about 10 lbm of hydrocarbons per 1,000 gallons; a figure significantly higher than the previous figure of 3.65 lbm/1,000 gallons used in the IEE calculation for base year 2011. In practice, we note agreement within 10 to 15% between actual measured results and predicted values with the ARID ELM.

For a typical site with throughput of 150,000 gallons per month, an approximate 4 year payback is seen with an after-tax internal rate of return of 23%. For the interval 2012 – 2022, 98.68 tons of emissions are avoided while fuel savings of $132,832 are accumulated **from a single GDF**. These economics are for the capital equipment sale of ARID's PERMEATOR. An installed cost of $40,000 is used in this analysis.

ARID offers Permeator under two options: (1) Capital Equipment Purchase, or (2) Shared Savings Arrangement. With the capital purchase option, the one-off list price of the Permeator is $37,000, which includes a 3 year warranty on parts & labor. Under the shared savings arrangement, the Permeator is supplied at zero cost, and the customer makes monthly payments equal to 50% of the saved fuel value. In this manner, even GDF with relatively small throughput can take advantage of the fuel savings and emissions reduction benefits of PERMEATOR.

Summary

Using the number of CT Stage II sites referenced in the Klausmeier summary; if the two smallest throughput categories are exempt from using State-of-the-Art technology to mitigate vapor emissions (< 300,000 gal/year and 300,000-500,000 gal/year categories); the remaining 1,060 Connecticut sites are viable candidates for emissions reductions and associated fuel savings. If one subtracts the annual fuel consumption estimated from the two smallest throughput categories (approx. 270,000,000 gal/yr.) from the annual consumption figure of 1,514,621,566 gal/yr.; the remaining throughput of 1,244,621,566 gallons per year passing through 1,060 GDF sites will yield significant fuel savings and emissions reductions.

Tables 4A, 4B, 4C, 4D and 4E below present a summary of the fuel savings and emissions reductions for the State of Connecticut, along with cost data. In these Tables, the IEE emissions are based on a more realistic figure calculated via the ARID ELM, these IEE factors are listed in the Evaporative Loss Model presented on page 10 of this summary. In addition, the Status-Quo, Klausmeier recommendation and State-of-the-Art options are compared. Moreover, per the rationale above, ARID assumes that 82% of the State of Connecticut's gasoline volumes will pass through Stage II vacuum assisted GDF, numbering 1,060 sites.

Table 4A: Refueling Emissions: State of CT

			1	2	3
Year	**ORVR Penetration Rate**	**Gasoline Throughput**	**Refueling Emissions**	**Refueling Emissions**	**Refueling Emissions**
		gal/year	*No Stage II/ No ORVR*	*No Stage II/* ***With ORVR***	*With Stage II/ With ORVR*
			tons/year	*tons/year*	*tons/year*
2011	69%	1,244,621,566	5,227	1,800.84	522.74
2012	71%	1,244,621,566	5,227	1,701.52	522.74
2013	72%	1,244,621,566	5,227	1,651.86	522.74
2014	74%	1,244,621,566	5,227	1,552.54	522.74
2015	75%	1,244,621,566	5,227	1,502.88	522.74
2016	77%	1,244,621,566	5,227	1,403.56	522.74
2017	78%	1,244,621,566	5,227	1,353.90	522.74
2018	79%	1,244,621,566	5,227	1,304.24	522.74
2019	80%	1,244,621,566	5,227	1,254.58	522.74
2020	81%	1,244,621,566	5,227	1,204.92	522.74

Table 4B: Vent, Fugitive & Total Emissions (includes IEE Emissions)

Connecticut - Statewide

4	5	6	7	8 (Klausmeier)	9 (Status Quo)	10 (State of the Art)
Storage Tank Vent & Fugitive Emissions	**Storage Tank Vent & Fugitive Emissions**	**Storage Tank Vent & Fugitive Emissions**	**Total Emissions (Refueling + Storage Tank)**	**Total Emissions (Refueling + Storage)**	**Total Emissions**	**Total Emissions**
With Stage II/ with ORVR No Processor	*No Stage II/ with or without ORVR No Processor*	*With Processor*	*No Stage II, No ORVR, No Processor*	*No Stage II, With ORVR, No Processor*	*Stage II & ORVR, no Processor*	*Stage II, ORVR with Processor*
tons/year	*tons/year*	*tons/year*	*tons/year*	*tons/year*	*tons/year*	*tons/year*
6,129.76	2,043	42.91	7,271	3,844	6,652.50	565.65
6,191.99	2,064	43.34	7,291	3,766	6,714.73	566.09
6,256.78	2,086	43.80	7,313	3,737	6,779.52	566.54
6,320.75	2,107	44.25	7,334	3,659	6,843.49	566.99
6,386.00	2,129	44.70	7,356	3,632	6,908.75	567.44
6,452.56	2,151	45.17	7,378	3,554	6,975.30	567.91
6,520.45	2,173	45.64	7,401	3,527	7,043.19	568.38
6,589.69	2,197	46.13	7,424	3,501	7,112.44	568.87
6,660.33	2,220	46.62	7,448	3,475	7,183.07	569.36
6,732.37	2,244	47.13	7,472	3,449	7,255.11	569.87

Table 4C: State of the Art vs. Klausmeier & Status Quo

Connecticut - Statewide

State of CT Savings	**Emissions Reductions**	**Fuel Savings**	**Fuel Savings**	**State of CT Savings**	**Emissions Reductions**	**Fuel Savings**	**Fuel Savings**
State of the Art vs. Klausmeier				***State of the Art vs. Status Quo***			
tons/year	*%*	*gal/year*	*$/yr. @ $3.50/gal*	*tons/yr.*	*%*	*gal/yr.*	*$/yr.*
3,278	85%	1,311,379	4,589,826	6,087	91%	2,434,741	8,521,594
3,199	85%	1,279,774	4,479,208	6,149	92%	2,459,459	8,608,108
3,171	85%	1,268,367	4,439,283	6,213	92%	2,485,193	8,698,175
3,092	85%	1,236,989	4,329,461	6,277	92%	2,510,603	8,787,110
3,064	84%	1,225,642	4,289,748	6,341	92%	2,536,521	8,877,823
2,987	84%	1,194,602	4,181,106	6,407	92%	2,562,957	8,970,350
2,959	84%	1,183,599	4,142,597	6,475	92%	2,589,922	9,064,728
2,932	84%	1,172,774	4,104,709	6,544	92%	2,617,427	9,160,993
2,905	84%	1,162,129	4,067,453	6,614	92%	2,645,481	9,259,184
2,879	83%	1,151,669	4,030,843	6,685	92%	2,674,097	9,359,339
			Total $ 42,654,234				Total $ 89,307,403

Table 4D: Revenue per Ton of Emissions Reduced

CT Sites for Processor	*Cost per CT Site, Installed*	*Average Fuel Savings, Statewide*	*Average Emissions Reductions, Statewide*	*Emissions Reductions Cost or Revenue*
Number	*$*	*10 year period; $/yr. @ $3.50/gal*	*10 year period; tons/year*	*Revenue, $/ton reduced*
1,060	40,000	8,930,740	6,379	1,400

Table 4E: Revenue per Ton of Emissions Reduced

Total Cost for Processors	*Financing Cost*	*Net Cost (Net Revenue)*	*Net Revenue for Emissions Reductions*
$	*10 yr., straight line*		
	$/yr.	*$/yr.*	*$/ton*
42,400,000	4,240,000	+ 4,690,740	+ 735

The cost to equip and install 1,060 sites with Processors (under a capital equipment purchase) is approximately $40,000 x 1,060 = $42.4 million. Assume 10 year depreciation to yield annual cost of $4.24 million per year. The net cost is then + $8.93 million/yr. - $4.24 million/yr. = + $4.69 million/yr.; where the cost per ton of emissions reduced; is not a cost, but rather a revenue equal to ;

- (+ $4.69 million/yr.) / (6,379 tons/year) = + $735 in revenue generated/ ton of VOC reduced

The chart summarizes the emissions is presented below, and we obtain dramatically different figures from Table 22 and Table 27 shown in the Klausmeier report.

In conclusion, the elimination of Stage II and sole reliance on ORVR technology does not provide the State of Connecticut with optimal emissions reductions; in terms of both refueling and storage tank emissions. Overlooked in past studies and analyses on this topic are two key elements: 1.) The raw, uncontrolled emissions from non ORVR vehicles, and 2.) The impact of using active processors to manage storage tank pressure and significantly reduce storage tank emissions comprised of vent and fugitive emissions.

The brief analysis above shows that the use of an active processor such as the ARID Permeator provides the following benefits to a GDF:

- *Enhancement of Stage I; pressure spikes during bulk tanker deliveries are processed by Permeator*
- *Enhancement of Stage II; providing ORVR/Stage II Compatibility, without the use of any special nozzles or other special hardware on the "front-end" Stage II system (i.e. Conventional Stage II can remain in place)*
- *On-going and continuous pressure monitoring; we measure tank pressure every 4 seconds and store a 2 minute average; we also monitor and store ambient temperature and atmospheric pressure; where any critical variables (such as tank pressure) which fall outside of a prescribed range trigger an automatic e-mail alert sent to our central monitoring center*
- *Economical payback on invested capital; where the fuel savings rate averages 2 gallons of fuel saved per 1,000 gallons of fuel dispensed*
    - *For smaller throughput sites, the Permeator system is available under a shared savings arrangement; whereby the unit is provided for zero cost, and the GDF owner/operator makes monthly payments to ARID equal to 50% of the fuel savings*

The aggregate benefits for the State of Connecticut GDF operators include $8.9 million per year in fuel savings while at the same time reducing emissions of volatile organic compounds and air toxics by 6,379 tons per year.

Further Note

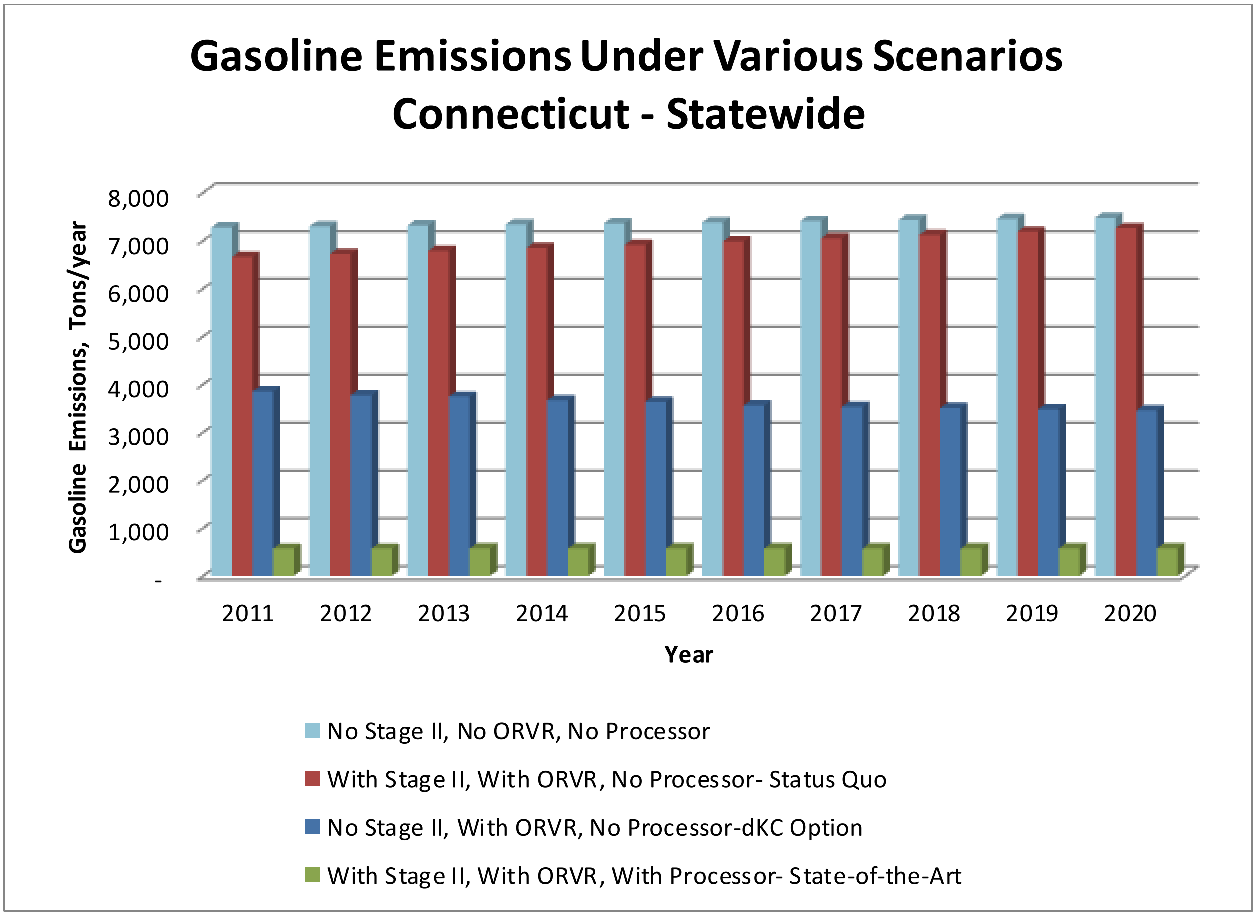
ARID does not seek a regulatory mandate or requirement for Connecticut GDF to use an active processor such as Permeator. However, we do believe that Connecticut GDF owners and operators should be made fully aware of viable options. Even if the compelling benefits of the State-of-the-Art approach using Stage II/ORVR/and Active Processors are ignored by US EPA and the State of Connecticut; ARID believes that individual GDF owners and operators should be free to continue to use Stage II, ORVR and an active processor.

We read with interest the section in the Federal Register which addresses SIP Revision; specifically the section 110 (l) requirements as well as the Clean Air Act Section 116; where States remain free to choose to implement Stage II programs in any area. Perhaps States that continue to use Stage II, in conjunction with a vapor processor will qualify for special state-of-the-art, or MACT status.

This qualification could trigger financial incentives to the GDF owner/operator such as reduced taxes on motor vehicle fuel and/or a subsidy to help cover the capital and installation expenses of installing vapor processor hardware. Moreover, the State may also qualify for various financial incentives while at the same time earning emissions reductions in their SIP. It seems reasonable to reward the proactive States and GDF owner/operators who employ a state-of-the-art approach to reduce emissions above and beyond mandated levels. On the one hand, they will earn an attractive return by paying back their capital investment with saved fuel, but on the other hand, an extra incentive can help ensure that Stage II systems are not incorrectly removed in “knee-jerk” reaction by the majority of the GDF owner/operators.

As an added benefit to regulatory agencies, the efforts expended by the GDF owner/operator will be much stronger and more focused if their “good housekeeping” practices earn them the opportunity to realize an economic benefit – in other words; why ensure leak integrity of your vapor piping system, if you know the losses are constantly occurring through the p/v valve ? However, if the GDF owner/operator installs and maintains Stage II technology along with a vapor processor; they have a strong financial incentive to make sure all systems on the forecourt are properly operating and that the associated piping system remains leak free.

We hope our technical comments and critical review of the Klausmeier report will help CT DEP and EPA to better understand the key technical issues in the interaction of Stage II and ORVR operations at GDF’s. With this knowledge in-hand, we hope that regulatory agencies can craft a thoughtful, science-based approach to reduce GDF hydrocarbon emissions in the optimum manner. To that end, ARID stands ready to assist this effort in an objective way.



A Note About the Use of MOVES and Additional Data Used in dKC Analysis

We have been involved in this industry for 19 years, and the analysis presented in Appendix A on prediction of "widespread use"; pages 32-41 was extremely difficult to follow. The analysis seems overly complex, with a multitude of assumptions, models and factors to allow backing in to a "widespread use date". It appears as though Mr. Klausmeier misses the fundamental point that refueling emissions are generated at the automobile/nozzle interface and that vent & fugitive emissions (IEE) are generated within the storage tank. We feel the analysis presented by ARID in this summary more accurately and logically describes and quantifies the Stage II/ORVR dynamics.

In addition, in Appendix B, Mr. Klausmeier references CARB text which must pre-date 2006; as the ARID CARB Certification G70-209 is not mentioned for ORVR Compatibility. ARID received this Certification in October, 2006.